

# High Temperature Chemical Sensor Array Payload For UAV Based In-situ Volcanic Gas Measurements, Phase I

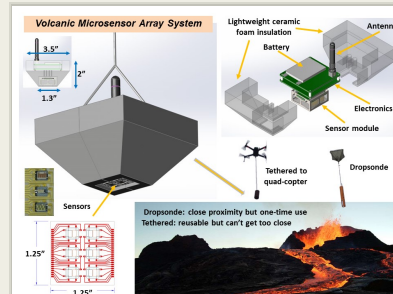
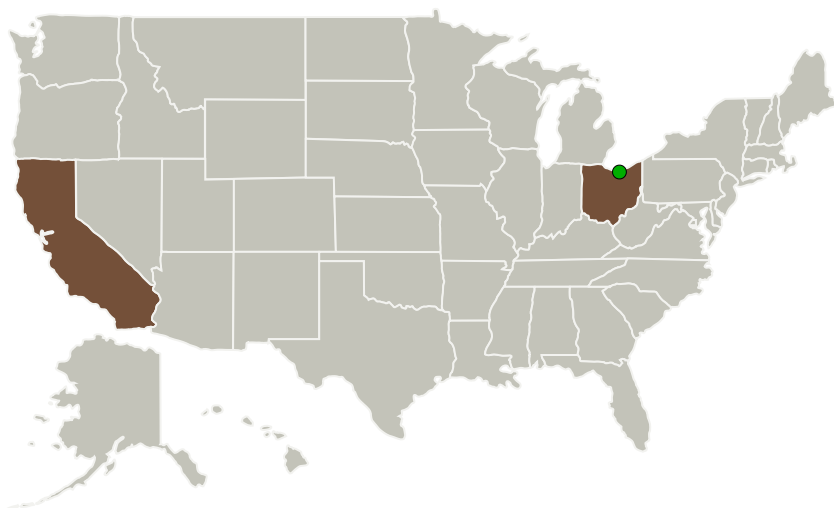
Completed Technology Project (2016 - 2016)



## Project Introduction

Makel Engineering, Inc. proposes to develop a low cost, UAV based microsensor array payload for monitoring volcanic processes such as plume vents and hot lava flows. Microsensor arrays, each consisting of four to eight high temperature sensors for species such as OCS, HF, HCl, NO<sub>x</sub>, CO, SO<sub>x</sub>, CH<sub>4</sub>, H<sub>2</sub>O, O<sub>2</sub>, and CO<sub>2</sub>, will be packaged with electronics and data transmission capability. The high temperature thick and film microsensors for the species of interest have been developed for Venus atmospheric measurement under a previous NASA program. This sensor technology will be the basis of this low cost UAV payload for Earth science missions. The microsensor array packages will be integrated into lightweight payloads (under 200 gm) that can be suspended under a small UAV multi-copter for measurements near lava flows. Alternately, the microsensor array payload can be packaged as a dropsonde and deployed in regions which are too hostile for low altitude UAV flight. The Volcanic Microsensor Array System (VMAS) packaging will be designed to enable the sensors to be used for prolonged operation in high temperature, turbulent, and corrosive gas environments. The microsensor array will be sufficiently low cost that it can be expendable and can transmit data from regions where it is impractical to retrieve instrumentation. This innovative use of a low cost microsensor array can provide measurements not feasible with more expensive and sophisticated instruments which cannot be sacrificed in high risk measurement areas.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Makel Engineering, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Chico, California
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

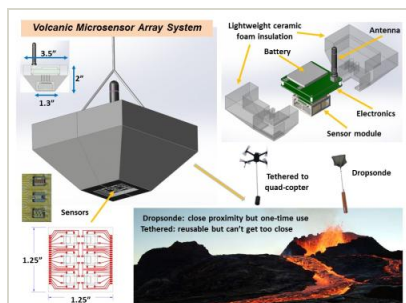
California	Ohio
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## Project Transitions

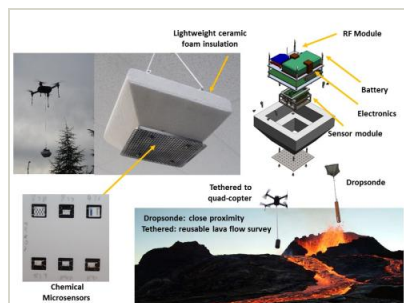
**June 2016:** Project Start**December 2016:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139694>)

## Images

**Briefing Chart Image**

High Temperature Chemical Sensor Array Payload For UAV Based In-situ Volcanic Gas Measurements, Phase I

(<https://techport.nasa.gov/image/135088>)**Final Summary Chart Image**

High Temperature Chemical Sensor Array Payload For UAV Based In-situ Volcanic Gas Measurements, Phase I Project Image

(<https://techport.nasa.gov/image/131184>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Makel Engineering, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

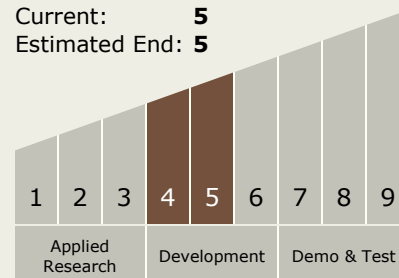
Carlos Torrez

**Principal Investigator:**

Darby B Makel

## Technology Maturity (TRL)

Start: 4  
 Current: 5  
 Estimated End: 5



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## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.3 In-Situ Instruments and Sensors
    - └ TX08.3.4 Environment Sensors

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System